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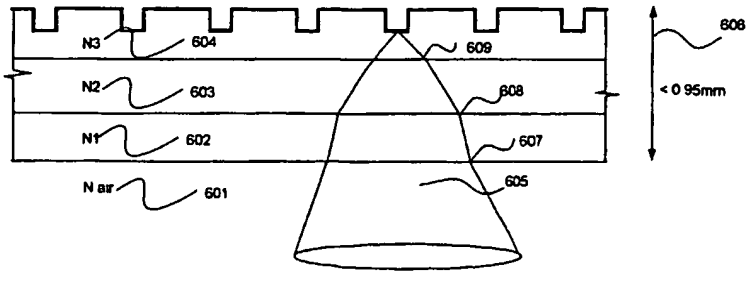
(54) Title: HYBRID IN WIDTH SPEC OPTICAL DISC UTILISING A DVD AND A CD SIDE AND A METHOD FOR MANUFACTURING A DOUBLE DENSITY SIDE



(57) Abstract: A system and method is described for creating a hybrid CD/DVD optical disc such that its overall width is between 1.1 mm and 1.5 mm wide such that it then conforms to the width specification for optical disc stackers and disc caracole changers. A further system and method is disclosed on how to manipulate the refractive index on the sub straight materials such to compensate for out of spec thin CD or DVD sides so that they work within spec on the reading laser if this is necessary. A further system and method for manufacturing hybrid CD/DVD disc where the DVD side has double the density of a normal DVD5. Thus the resultant disc is a DVD9Hybrid disc suitable for use with any normal DVD9 content where a CD is also part of the optical disc. The method also produces much higher yield than in the conventional DVD18 manufacturing techniques where used to make such a disc and thus the cost of production is significantly lower.

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HYBRID IN WIDTH SPEC OPTICAL DISC UTILISING A DVD AND A CD SIDE AND A METHOD FOR MANUFACTURING A DOUBLE DENSITY SIDE

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates generally to CD and DVD optical media, and more particularly to hybrid CD/DVD optical disc and a method of manufacture a double density DVD side in a hybrid CD/DVD disc.

Description of Related Art

[0002] Recently, optical disc specifically the CD Audio format has lapsed into public domain after the natural term of its patent life and sales in the product class of CD Audio optical disc are peaking indicating the onset of a new optical disc format, mainly DVD Audio. CD Audio optical disc are 1.2mm wide and are allowed to be 1.1mm to 1.5mm in width under the specification known as the red book.

[0003] At the same time the market has developed the DVD optical disc. Sales of this format are just starting. The DVD optical disc is 0.6mm wide but is laminated to either a second layer of DVD information (DVD9, DVD10 and DVD18) or to a blank 0.6mm wide sub straight so that the overall thickness of the disc is 1.2mm. In this way the industry has guaranteed continuity of transport and/or clamping mechanism mechanism know how that work with 1.1mm to 1.5mm wide disc. DVD sides are allowed to be typically 0.52mm to 0.68mm in width under the terms of the specification called the blue book.

[0004] Further a hybrid optical disc consisting of a CD laminated to the rear of a DVD based on WO 98/38637 having a thickness of 1.62mm has been released on the market. The 1.62mm width is derived by laminating the

thinnest CD Audio allowable under the red book specification (1.1mm) to the thinnest DVD side allowable under the blue book specification (0.52mm).

[0005] The hybrid optical disc having CD Audio on one side and DVD information on the other side is useful as it allows for the combination of old art with current art so that there is a cross compatible product that will play on a CD player or a DVD player. This is most useful for the music industry as it needs a hybrid optical disc in the short term so that it can safely transfer from the CD Audio 16bit 44.1kHz sampling specification format to the new DVD Audio 24 bit 96kHz style sampling rate. A release can contain both formats on a CD/DVD hybrid optical disc and therefore not alienate the market that does not have the new DVD Audio players. They allow the record companies to reduce cost involved in releasing one product in two formats as individually autonomous optical discs.

[0006] The CD/DVD caracole market has designed their mechanical tolerances to the CD Audio specification. Thus these multi disc transport and/or clamping mechanisms, as often found in car stackers and 5 caracole disc players and the like can handle optical disc that are between 1.1mm and 1.5mm wide. Unfortunately this excludes the 1.62mm hybrid optical disc designed within the red and blue book compatibility standards on minimum side thickness as the hybrid disc is too wide for car stackers and 5 disc caracole players and the like. Thus the 1.62mm hybrid optical disc is incompatible with car stackers and multi disc caracole players and the like and therefore difficult to market.

[0007] Therefore, there is a need for a hybrid CD/DVD optical disc that is less than 1.5mm wide and preferable between 1.1mm and 1.5mm is width such that it will play on car stackers and 5 disc caracole players and the like.

[0008] Provisional Patent Application no. 2002950808 lodged in describes a super thin hybrid CD/DVD disc, which substantially overcomes

problems of the WO 98/38637 patent application. However, the super thin hybrid CD/DVD disc is limited in capacity on the DVD side to 4.7 Giga Bytes as the DVD side is a DVD5 technology. We refer to this disc (Provisional Patent Application no. 2002950808 lodged in Australia) as a DVD5Hybrid.

[0009] Most movies and current DVD titles utilize a technology called DVD9, which uses a special manufacturing method to achieve a double density DVD side with a capacity of 9 Giga Bytes, as is well known in the art. Therefore, the market for the original DVD5Hybrid is limited to lower bit rate movies or DVD Audio content where the capacity of the DVD side is greater than 4.7 Giga Bytes. There is genuine market interest in making hybrid disc that have a 9 Giga Byte capacity DVD combined with a CD. We refer to this disc as a DVD9Hybrid.

[0010] Therefore, there needs to be an economic manufacturing method to overcome the limitations of the original DVD5Hybrid discs and produce a DVD9Hybrid disc.

SUMMARY OF THE INVENTION

[0011] The present system and method provides means for producing hybrid optical disc consisting of a CD on one side and a DVD on the other side such that the total hybrid optical disc are within the width specification as set by the red and blue book standard.

[0012] A further system and method provides a way to manufacture a DVD9Hybrid using in part the prior art manufacturing technique of the DVD18 process, as is well known in the art. However, the prior art method of manufacturing DVD18 has very low yield with typically a 40% reject rate. Thus the cost of the disc can be around four times that of a DVD9 disc due simply to failure rates. The further system and method to produce a DVD9Hybrid disc is performed without using the full DVD18 manufacturing process and thus with yield improvement of as little as 5% reject rate or similar rates as are experience in manufacturing DVD5 and DVD9.

[0013] The present invention may be utilized in various industries such as the music industry, the DVD Video movie industry, and other industries that use either CD or DVD optical disc as a format. Other advantages, features, and embodiments of the present invention will be apparent from the drawings and detailed description as set forth below.

[0014] The further system and method invention may be utilized in various industries such as optical disc replication. Other advantages, features, and embodiments of the present invention will be apparent from the drawings and detailed description as set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] FIG. 1 is a block diagram of a prior art CD Audio optical disc system as defined by the red book standard.

[0016] FIG. 2 is a block diagram of a prior art DVD optical disc system as defined by the blue book standard.

[0017] FIG. 3 is a block diagram of a prior art hybrid CD/DVD optical disc system as defined by patent application WO 98/38637.

[0018] FIG. 4 is a block diagram of a hybrid CD/DVD optical disc system that is between 1.1mm and 1.5mm in width that uses the DVD layer as a shim so that the CD side data layer is presented closer to the read laser focusing optics and vise versa.

[0019] FIG. 5 is a block diagram of a hybrid CD/DVD optical disc that is 1.48mm in width and uses a lower refractive index sub straight material than normal to compensate for the reduced width so that the read laser will further function within its design principles.

[0020] FIG. 6 is a block diagram of an CD optical disc that is made of a plurality of laminated sub straights with at least one sub straight having a different refractive index to the others.

[0021] FIG. 7 is a block diagram of a Prior Art 1st step process in making a DVD18 disc.

[0022] FIG. 8 is a block diagram of a Prior Art 2nd step process in making a DVD18 disc.

[0023] FIG. 9 is a block diagram of a Prior Art 3rd step process in making avDVD18 disc.

[0024] FIG. 10 is a block diagram of a 1st step process in making a DVD9Hybrid disc.

[0025] FIG. 11 is a block diagram of a 2nd step process in making a DVD9Hybrid disc.

[0026] FIG. 12 is a block diagram of a 3rd step process in making a DVD9Hybrid disc.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0027] The present system and method overcomes or substantially alleviates present limitations associated with hybrid CD/DVD optical disc.

[0028] Figure 1 is a block diagram of a prior art CD Audio optical disc as defined by the red book standard. The CD is typically made from optical grade polycarbonate 100 which has an approximate refractive index N = 1.55. The optical disc sub straight 100 also contains a pitted surface 101 that is sputtered with target material as is well known in the art. Typically, a protective lacquer 102 is applied by spin coating to protect pitted surface 101 and the coating of sputtered target material. The overall width 113 of the optical disc is typically 1.2mm but can be anywhere between 1.1mm and 1.5mm. Laser 109 sends light through a moving platform 110 containing a lens 103 such that it can be focused at the source in such a way to cause a diameter 104 of typically 0.8mm of light at an angle of incidence to the surface 117 of the optical disc sub straight 100 of typically 27 degrees 107 from the normal. A 0.8mm diameter of light 104 on the surface 117 of a 1.2 mm optical grade polycarbonate sub straight 100, when incident at 27 degrees 107 from the normal shall cause an angle of refraction of typically 17 degrees 108 for the light within the sub straight 100. A 0.8mm diameter circle 104 of light on the surface 117 of the sub straight 100 shall focus into typically 16-micron wide diameter of light 105 at the pitted surface 101. The typically 16-micron diameter of light 105 is exactly right for tracking and reading the track of spiral data off the layer of information on the pitted surface 101 as is well known in the art. The target material, typically aluminum, reflects the laser light and depending on the pit depth will cause interference or reinforcement of the incoming laser

light. The reflected laser light follows the same optical path as the incoming light with the reversed angles of incidence and refraction.

[0029] The angles of incidence and refraction of light as it passes between two materials is controlled by the relationship of the refractive indexes of the two materials. One material being air, with a refractive index of $N \approx 1$, and the other material being optical grade polycarbonate that has a refractive index of typically N=1.55.

[0030] The relationship is controlled by the formulae;

$$\sin\theta_i/\sin\theta_r = N_i/N_r$$

[0031] The refractive index for a material is controlled by the speed of light in that material compared to the speed of light in a vacuum ($3 \times 10^8 ms^{-1}$). For air, the speed of light is substantially the same as the speed of light in a vacuum. Thus;

$$N_{air} \approx 1.$$

[0032] The speed of light in optical grade polycarbonate is $1.99 \times 10^8 ms^{-1}$. Thus;

$$N_{ogp} = 3 \times 10^8 ms^{-1}/1.99 \times 10^8 ms^{-1} = 1.55$$

[0033] Typically the CD optical disc sits on a transport and/or clamping mechanism 111. This transport and/or clamping mechanism 111 presents the optical disc outer surface 117 at a distance from the laser lens 103 that is within design expectations and tolerance to allow the movement 110 of the laser lens 103 to correctly focus the light onto the surface 117 of the disc to

achieve the correct focus radius 105 on the pitted surface 101. The distance the outer surface 117 of the optical disc is presented from the laser lens 103 is the distance 112 from the transport and/or clamping mechanism 111 to the laser 109 minus the width 113 of the optical disc. CD players are designed to be in spec such that they expect the surface 117 of the disc to be somewhere between 1.1mm to 1.5mm above the transport and/or clamping mechanism 111 as these are the allowable widths for CD optical disc under the red book.

[0034] FIG. 2 is a block diagram of a prior art DVD optical disc as defined by the blue book standard. The surface of the disc is presented the same relative distance principles from the laser lens 209 as a CD audio because the DVD disc is 1.2mm wide 213 even thought its data layer 201 is 0.6mm 214 below its outer surface 200. The laser 209 is of a higher frequency, therefore a shorter wavelength, and the focus radius 206 of the laser on the disc surface 200 is smaller and the radius formed by the laser light on the pitted surface 205 is smaller. However, the same design principles apply as for the prior art CD.

[0035] FIG. 3 is a block diagram of a prior art hybrid CD/DVD optical disc as defined by patent application WO 98/38637. It has a minimum allowable CD 302 under the red book spec (typically 1.1mm) laminated to the back of a minimum allowable DVD half 303 under the blue book spec (typically 0.52mm). The total width 304 of the disc is 1.62mm. However, this has problems in that it presents the surface of the CD side 301 or the DVD side 306 0.12mm above the expected design point specified by the red and blue book standards for the distance between the transport and/or clamping mechanism 311 and the laser 309. It is also 0.12mm wider that the distance specified for the maximum width of an optical disc under the red book and blue book standards and therefore will not load in most automatic stacker as found in car audio and in 5 disc caracole players and the like. Therefore the

versatility and therefore market acceptance of this prior art 1.62mm hybrid optical disc is limited.

[0036] FIG. 4 is a block diagram of a hybrid CD/DVD optical disc that is between 1.1mm an 1.5mm in width 403 that uses the DVD side 401 as a spacing shim so that the CD side surface 411 is presented within the specified expected design distance to the read laser 409 as specified for an optical disc manufactured under the red book specification (greater than 1.1mm and less than 1.5mm). Conversely, when played in the flipped side the CD side 401 acts as a spacing shim so that the DVD side surface 410 is presented with in the specified design distance to the read laser as specified for an optical disc manufactured under the blue book specification for an optical disc (1.1mm to 1.5mm). To achieve this disc the CD side width 404 has been decreased to 0.95mm (equivalent to 13.6% less than the minimum width of 1.1mm allowed for a non hybrid CD optical disc under the red book specification).

[0037] The CD side 402 has essentially twice the sensitivity to absolute distance variations, as does the DVD side 401. The optical distance to travel within the refractive material (optical grade polycarbonate) is 1.2mm in a normal CD and 0.6mm in a normal DVD. Thus a 0.1mm of change in a CD side width represents;

$$0.1/1.2 = 8.3\%$$

[0038] while a 0.1mm change in a DVD side width represents;

$$0.1/0.6 = 16.7\%$$

[0039] The DVD side is far more sensitive to absolute width variations as the wavelength and therefore absolute tolerances are tighter. Thus the DVD side is chosen to have the minimum under the blue book standard that is typically 0.52mm. The CD side is reduced to 79% of 1.2mm so that it is 0.95mm wide and gives an overall thickness 403 to the hybrid disc of 1.48mm.

As the CD side data sub straight 407 is presented closer to the laser 409 the reduced thickness still lays within the effective focus range of most CD players.

[0040] It may be that some CD players cannot focus on the 0.95 mm width CD side (figure 4) as the pitted surface is presented too close to the laser which is unable to focus correctly due to the optical path within the medium being shorter (optical grade polycarbonate typically N=1.55). Figure 5 is a block diagram of a hybrid CD/DVD optical disc that is between 1.1mm and 1.5mm in width 501 and uses a lower refractive index (N=1.45) 502 to compensate for the CD Audio side 503 width so that the read laser 509 functions within its design principles. A refractive index less than that of optical grade polycarbonate typically N=1.55 can be used to cause the angle of refraction with in the sub straight to be greater than 17 degrees. Thus the pitch of the internal laser light will be stepper and it will therefore focus on a surface that is closer.

[0041] It may be useful to use a different refractive index on one side of the hybrid disc then on the other side of the hybrid disc.

[0042] By using this technique it is possible to achieve CD sides, or DVD sides that are individually less than those allowable under the red and blue book specifications but when mutually bonded are within the red and blue book width specification (1.1mm to 1.5mm). For example, an alternate material than optical grade polycarbonate may be used, or an additive added to optical grade polycarbonate so that its refractive index changes to say 1.45 or something less than 1.55.

[0043] Variable material layers may be used to achieve piecewise linear layered curving on the laser beam light within different refractive index materials to achieve thinner optical disc sides. Figure 6 shows a CD optical disc side that uses plurality of laminated layers of different refractive material N1 602, N2 603, and N3 604. The laser light 605 refracts at the juncture 607 of N air

601 and N1 602. At the juncture of these layers a refraction angle effect will transpire as described previously. The laser light 605 then again refracts at the juncture 608 of N1 602 and N2 603 and again refracts at the juncture 609 of N2 603 and N3 604. By manipulating the refractive indexes N1 602, N2 603, and N3 604 the laser light 605 can be piece wise linear manipulated to shorten the path taken by the laser light within the sub straights and therefore reduce the overall thickness of the side 606. The same technique may be used on the DVD side.

[0044] A protective coating that may have a different refractive index than the side upon which it is applied may add an additional layer to a side and achieve some contribution to width reduction of that side.

[0045] Gradient variable refractive index materials may be used such that the refractive index is a gradient within the sub straight material thus achieving continuous curvature of the laser beam within the refractive material thus achieving a thinner CD or DVD side.

[0046] A further system and method overcomes or substantially alleviates present limitations associated with the present system hybrid CD/DVD disc capacity on the DVD side. It improves production yield in the manufacture of such disc than if they where produced using conventional DVD18 technology manufacturing techniques.

[0047] DVD9Hybrid disc can be achieved by using conventional DVD18 manufacturing methods by simply bonding one half of a DVD18 disc to a CD disc. However, the DVD18 manufacturing process has only typically 60% yield and thus the cost of this process would mean the resultant disc would have to be doubled in price to cover the cost of rejects. Therefore an alternative economic manufacturing method is required.

[0048] Figure 7 shows the 1st step process in manufacturing a prior art DVD18 disc. A polycarbonate normal DVD sub straight 700 with its

semi transparent target 702 applied is bonded 706 to an abnormal Plexiglas reversed DVD sub straight 703 (typically N=1.45) with its fully reflective target material 704 applied. The bonded layer 706 is made to be typically 70 microns wide thus fulfilling the requirement for DVD9 optical disc second layer distance. The DVD pits 705 are of mechanical dimensions of typically 60 microns high by 60 microns wide and are between typically 180 microns to 720 microns long. The DVD pits 705 of the reverse mastered DVD sub straight 703 have land where there are normally pits and vice versa, as is well known in the art.

[0049] Figure 8 shows the 2nd step process in manufacturing a prior art DVD18 disc. A high-pressure air jet 800 is applied to the side of the disc produced in the 1st step described above (figure 7). As the mechanical property of Plexiglas is that is adheres more poorly to fully reflective target material than does polycarbonate the high pressure air jet 800 cause the Plexiglas sub straight 703 to laminate from the rest of the structure made in the 1st step process. Thus a polycarbonate sub straight 700 with its semi transparent target material 702, the 70 micron bonding layer 706 and the fully reflective target material 704 all remain as one composite and form a half of a DVD18 disc.

[0050] Figure 8 shows the 3rd step process in manufacturing a prior art DVD18 disc. The half of a DVD18 901 produced in the 2nd step manufacturing process described above (figure 8) is bonded 903 to another half of a DVD18 902 produced using the same 2nd step manufacturing process. The result is a double-sided disc that presents effectively two DVD9 sides to the optical reader 904 and 905 depending which side of the disc is facing the optics. The benefit of such a disc is that its capacity is 18 Giga Bytes.

[0051] The problem with such a disc is that it is expensive to produce as when the air jet 800 (figure 8) is applied it often damages DVD pits

705 (figure 7) or causes lamination in part or in full to one of the other layer joints such as the junction of polycarbonate sub straight 700 to its semi reflective target material 702, or between the semi reflective target material 702 to the bonded layer 706, or the bonded layer 706 to fully reflective target material 704. The main reason this lamination or damage occurs is that the only difference between the different layers is the bonding strength of the target materials to polycarbonate and Plexiglas. Both layers 700 and 703 have DVD pits 705 which are identical in size and therefore structural strength. Thus, the definition of where the disc should laminate is somewhat subtly defined by the poorer bonding strength of the target material to Plexiglas.

[0052] It is however possible to take the half of a DVD18 produced in the 2nd step process described above (figure 8) and bond it to a CD to produce a DVD9Hybrid disc with double the density of a conventional DVD5 Hybrid disc. Although claimed in this patent, the yield is low and therefore the cost is high. This optical disc may use techniques described earlier to achieve an overall optical disc width between 1.1mm and 1.5mm.

[0053] Figure 10 shows the 1st step process in the further system and method for a manufacturing process claimed in this patent. A CD sub straight 1000, being either the conventional thickness described by the red book standard, or a super thin CD described with a fully reflective target material 1001 applied is bonded to a Plexiglas normal DVD sub straight 1003 which has its fully reflective target material 1004 applied. They are bonded 1002 together at any width that suits the final product (not optically sensitive). The CD sub straight 1000 has CD pits 1005 which are typically 120 microns high and 120 microns wide and typically 360 microns to 1234 microns long. The normal DVD sub straight 1003 has DVD pits 1006 that are of mechanical dimensions of typically 60 microns high by 60 microns wide and typically between 180 microns to 720 microns long.

[0054] Figure 11 shows the 2nd step process in the further system and method for a manufacturing process claimed in this patent. A high pressure air jet 1100 is applied to the side of the disc to cause the Plexiglas sub straight 1003 to laminate from the rest of the structure produced in the 1st step manufacturing process (figure 10). This includes the CD sub straight 1000, its fully reflective target material 1001, the non optically critical bonded layer 1002, and the DVD fully reflective target material 1004. Unlike the prior art methods for manufacturing DVD18 the lamination is well defined at the junction of the DVD target material 1004 to the DVD plexiglass sub straight 1003 as the mechanical dimension of the CD pits 1005 are much larger than the mechanical dimensions of the DVD pits 1006. The mechanical strength of the CD sub straight 1000 with its large CD pits 1005 and fully reflective target material 1001 bonded 1002 to the fully reflective target material 1004 with smaller DVD pits 1006 is a very strong structure. Therefore incorrect de-lamination is minimised and yields are far higher than in the prior art 'half of a DVD18' manufacturing process.

[0055] Figure 12 shows the 3rd step process in the further system and method for a manufacturing process claimed in this patent. The hybrid CD/DVD sub structure 1200 produced in the 2nd step process (figure 10) in the further system and method for a manufacturing process claimed in this patent is bonded 1202 to a pre sputtered polycarbonate normal DVD sub straight 1201 with its semi reflective target material 1205 already applied. The bonding process is controlled such that the resultant bonding layer 1202 is typically 70 microns wide as required by the DVD9 optical reading system. This system is a high yield process so when combined with the hybrid CD/DVD sub structure 1200 produced in the 2nd step process in the further system and method for a manufacturing process claimed in this patent a high yield disc is produced.

[0056] Various steps in the manufacture of the hybrid CD/DVD sub structure 1200 produced in the 2nd step process (figure 11) in the further system and method for a manufacturing process claimed in this patent have inherent benefit over the prior art DVD18 manufacturing process (figure 7&8) as all targets used to produce the hybrid CD/DVD sub structure 1200 produced in the 2nd step process in the further system and method for a manufacturing process claimed in this patent are fully reflective and therefore low cost and high strength (e.g. Aluminum). All DVD sub straights used to produce the hybrid CD/DVD sub structure 1200 produced in the 2nd step process in the further system and method for a manufacturing process claimed in this patent are normal, and therefore DVD5 style mastering and stampers can be used eliminating the need for manufacturing with reversed DVD glass masters, stampers and sub straights.

[0057] Although reference is made throughout this detailed description to hybrid CD/DVD, the shimming of thin disc and refractive index manipulations the methods can be applied to any other optical disc currently existing or to be invented including SACD.

[0058] Although further reference is made throughout this detailed description to manufacturing DVD9Hybrid discs, the new optical disc manufacturing method can be applied to any other optical disc currently existing or to be invented.

[0059] The invention has been described with reference to specific embodiments. It will be apparent to those skilled in the art that various modifications may be made and other embodiments can be used without departing from the broader scope of the invention. For example, alternative forms of optical disk media may be used in the present invention. Therefore, these and other variations upon the specific embodiments are covered by the present invention.

WHAT IS CLAIMED IS:

1. A hybrid CD DVD optical disc, comprising:

a DVD side; and

a CD side.

2. The hybrid disc of claim 2 further comprising at least one sub straight layer of different refractive index having a different refractive index to the others.

3. A hybrid CD DVD optical disc, comprising:

a DVD side; and

a CD side whereby the overall width of the hybrid optical disc is between 1.1mm and 1.5mm.

4. The hybrid disc of claim 3 wherein the at least one side of the disc has a refractive index that is different to the other side.

5. The hybrid disc of claim 3 wherein the at least one side of the disc uses a lower refractive index to achieve a thinner side.

6. The hybrid disc of claim 3 further comprising at least one piece wise linear layer of different refractive index.

7. The hybrid disc of claim 3 further comprising at least one layer of shim underneath the CD or DVD side to move the data layer closer to the focusing optics of the optical disc reader.

8. The hybrid disc of claim 3 wherein the optical disc further comprises a external surface layer of protective coating.

9. A system for manufacturing a double density DVD side on a hybrid D DVD optical disc, comprising:

a double density DVD side; and

a CD side.

10. The system of claim 9 wherein the overall width of the hybrid optical disc is between 1.1mm and 1.5mm.

11. A system for manufacturing a double density DVD side on a hybrid DVD optical disc, comprising:

a CD side;

a first DVD data layer; and

a second DVD data layer.

12. The system of claim 11 wherein the overall width of the hybrid optical disc is between 1.1mm and 1.5mm.

13. A system for manufacturing a double density DVD side on a hybrid DVD optical disc, comprising:

a CD side;

a first DVD data layer; and

a second DVD data layer.

14. The system of claim 14 wherein the overall width of the hybrid optical disc is between 1.1mm and 1.5mm.

AMENDED CLAIMS
[received by the International Bureau on 16 December 2003 (16.12.03);
claims 1-14 replaced by amended claims 1-39 (12 pages)]

1. A double sided hybrid CD DVD optical disc or double sided hybrid CD SACD optical disc, comprising:

a DVD or SACD side; and

a CD side.

2. The double sided hybrid disc of claim 1 further comprising a plurality of sub straight layers with at least one sub straight layer of refractive index different to the refractive index of the other layers.

3. A double sided hybrid CD DVD optical disc or double sided hybrid CD SACD optical disc, comprising:

a DVD or SACD side; and

a CD side

whereby the overall width of the double sided hybrid optical disc is between 1.1mm and 1.5mm.

4. The double sided hybrid disc of claim 3 further comprising a plurality of sub straight layers with at least one sub straight layer of refractive index different to the refractive index of the other layers.

5. The double sided hybrid disc of claim 3 wherein at least one side of the disc uses a lower refractive index than that of standard material to achieve a thinner side.

6. The double sided hybrid disc of claim 3 further comprising at least one side of which is formed by a plurality of sub straight materials of differing refractive index.

7. The double sided hybrid disc of claim 3 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader.

8. The double sided hybrid disc of claim 3 wherein the optical disc further comprises at least one external surface layer of protective coating.

9. A system for manufacturing a double density DVD or SACD side on a double sided hybrid CD DVD optical disc or double sided hybrid CD SACD optical disc, comprising:

a double density DVD or SACD side; and

a CD side.

10. The system of claim 9 wherein the overall width of the double sided hybrid optical disc is between 1.1mm and 1.5mm.

11. A system for manufacturing a double density DVD or SACD side on a double sided hybrid DVD or SACD optical disc, comprising:

a CD side; and

a first DVD or SACD data layer; and

a second DVD or SACD data layer.

12. The system of claim 11 wherein the overall width of the double sided hybrid optical disc is between 1.1mm and 1.5mm.

13. A system for manufacturing a double density DVD side on a double sided hybrid DVD optical disc, comprising:

a CD side; and

a first DVD data layer; and

a second DVD data layer.

14. The system of claim 13 wherein the overall width of the double sided hybrid optical disc is between 1.1mm and 1.5mm.

15. The double sided hybrid disc of claim 1 wherein at least one side of the disc uses a lower refractive index than that of standard material to achieve a thinner side.

16. The double sided hybrid disc of claim 1 further comprising at least one side of which is formed by a plurality of sub straight layers of differing refractive index.

17. The double sided hybrid disc of claim 1 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader.

18. The double sided hybrid disc of claim 1 wherein the optical disc further comprises at least one external surface layer of protective coating.

19. The double sided hybrid disc of claim 1 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader wherein the shim is not a detachable piece of the optical disc.

20. The double sided hybrid disc of claim 3 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader wherein the shim is not a detachable piece of the optical disc.

21. The double sided hybrid disc of claim 9 wherein at least one side of the disc uses a lower refractive index than that of standard material to achieve a thinner side.

22. The double sided hybrid disc of claim 9 further comprising at least one side of which is formed by a plurality of sub straight layers of differing refractive index.

23. The double sided hybrid disc of claim 9 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader.

24. The double sided hybrid disc of claim 9 wherein the optical disc further comprises at least one external surface layer of protective coating.

25. The double sided hybrid disc of claim 9 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader wherein the shim is not a detachable piece of the optical disc.

26. The double sided hybrid disc of claim 11 wherein at least one side of the disc uses a lower refractive index than that of standard material to achieve a thinner side.

27. The double sided hybrid disc of claim 11 further comprising at least one side of which is formed by a plurality of sub straight layers of differing refractive index.

28. The double sided hybrid disc of claim 11 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader.

29. The double sided hybrid disc of claim 11 wherein the optical disc further comprises at least one external surface layer of protective coating.

30. The double sided hybrid disc of claim 11 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader wherein the shim is not a detachable piece of the optical disc.

31. The double sided hybrid disc of claim 13 wherein at least one side of the disc uses a lower refractive index than that of standard material to achieve a thinner side.

32. The double sided hybrid disc of claim 13 further comprising at least one side of which is formed by a plurality of sub straight layers of differing refractive index.

33. The double sided hybrid disc of claim 13 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader.

34. The double sided hybrid disc of claim 13 wherein the optical disc further comprises at least one external surface layer of protective coating.

35. The double sided hybrid disc of claim 13 further comprising at least one thickness modification to the sub straight width on the read data layer side in consideration of the non read data layer side acting as a shim to move the read data layer closer to the focusing optics of the optical disc reader wherein the shim is not a detachable piece of the optical disc.

36. The double sided hybrid disc of claim 9 wherein a sub straight material is used during the manufacture process which yields low bonding strength to a target material to encourage separation at this bond when subjected to an external stress.

37. The double sided hybrid disc of claim 11 wherein a sub straight material is used during the manufacture process which yields low bonding strength to a target material to encourage separation at this bond when subjected to an external stress.

38. The double sided hybrid disc of claim 13 wherein a sub straight material is used during the manufacture process which yields low bonding strength to a target material to encourage separation at this bond when subjected to an external stress.

39. The double sided hybrid disc of claim 13 wherein first is manufactured a double sided hybrid CD DVD optical disc or a double sided hybrid CD SACD optical disc in which;

a sub straight material is used on the DVD or SACD side during the manufacture process to yield a lower bonding strength to the target material to encourage separation at the bond when subjected to an external stress; and

a further DVD optical disc layer or a SACD optical disc layer is then added.

Statement under Article 19(1).

These amendments do not impact the description and drawings.

The purpose of the amendments is to improve the clarity of what is novel and therefore what is claimed.

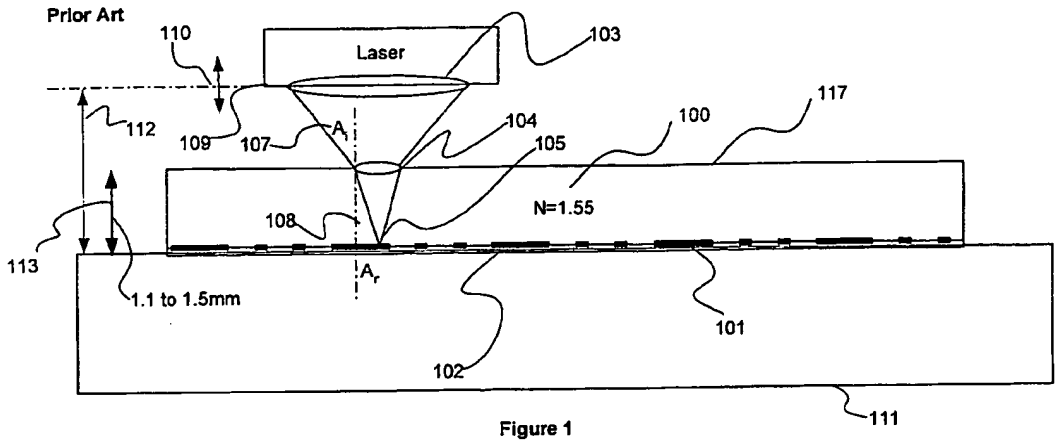

Figure 1

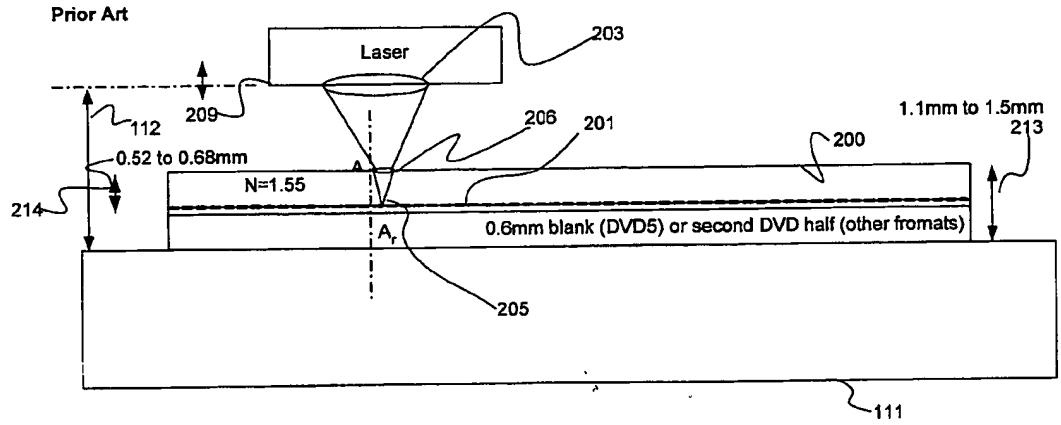

Figure 2

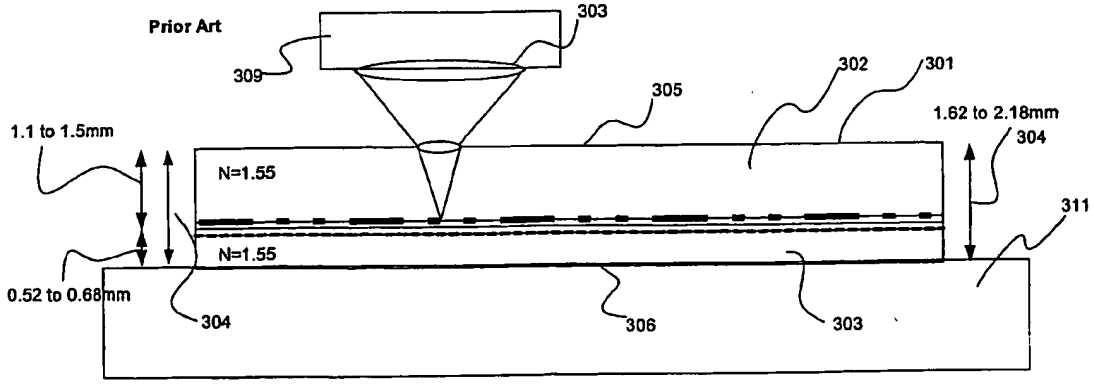

Figure 3

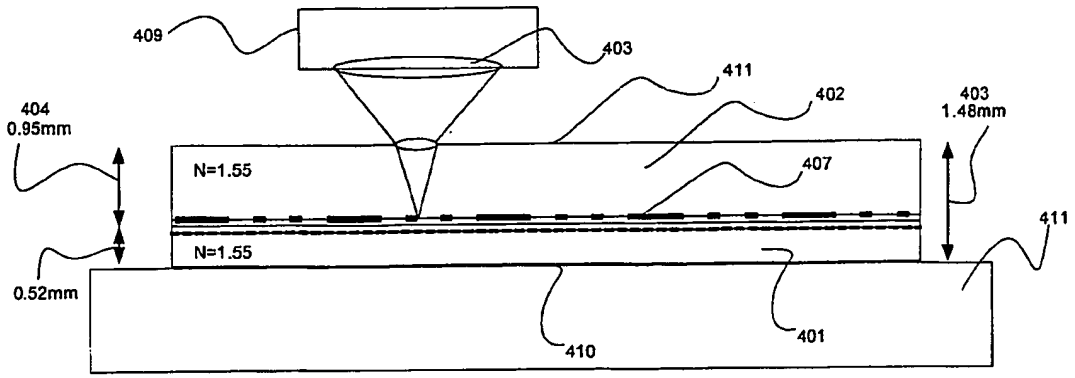

Figure 4

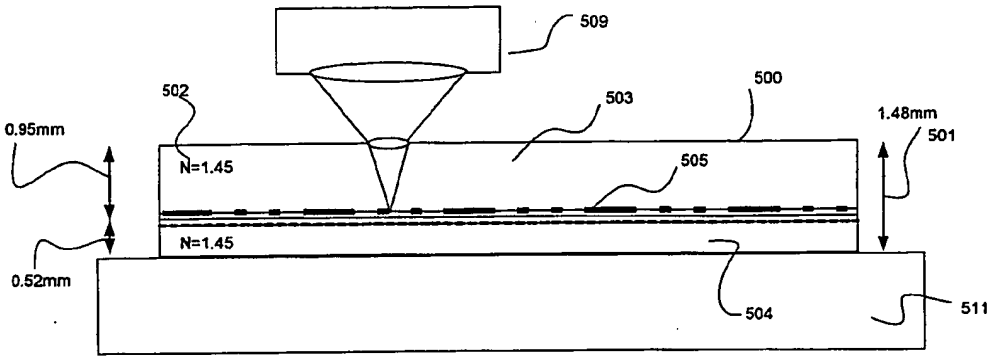

Figure 5

5

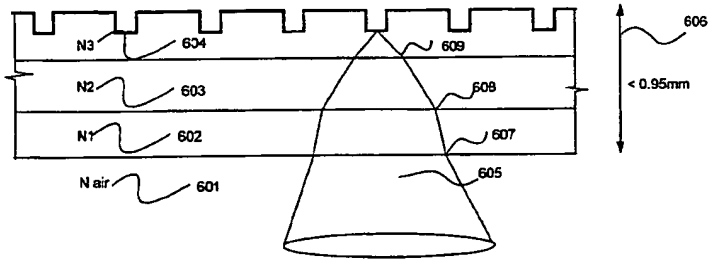

Figure 6

Prior Art

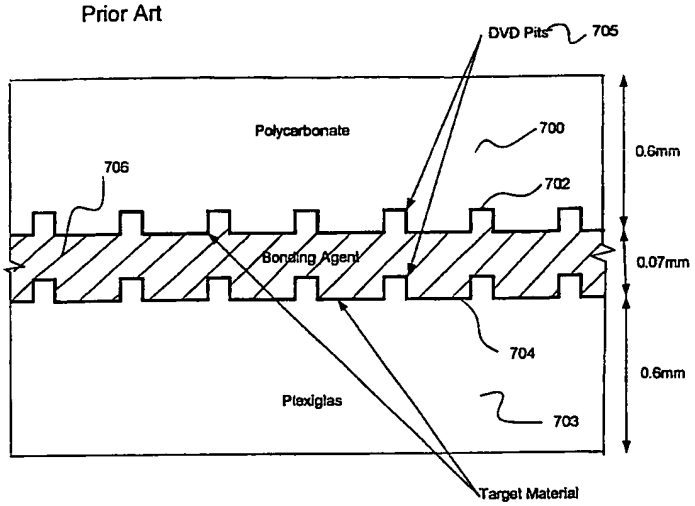

Figure 7

Prior Art

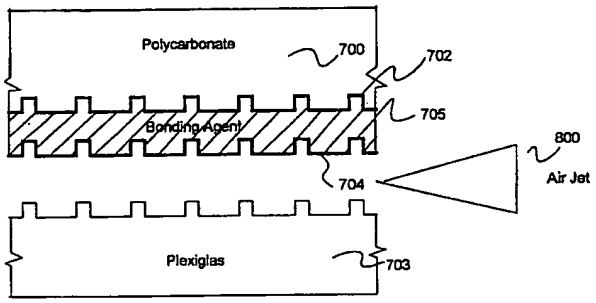

Figure 8

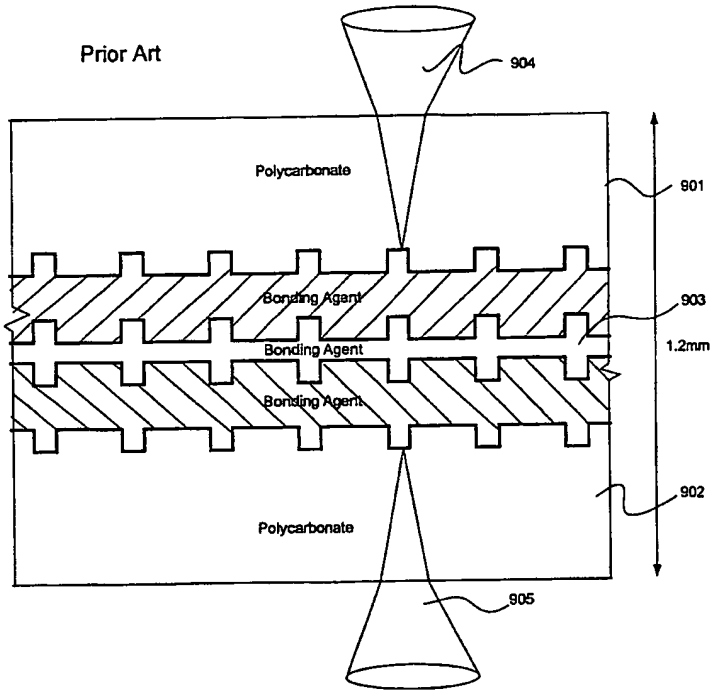

Figure 9

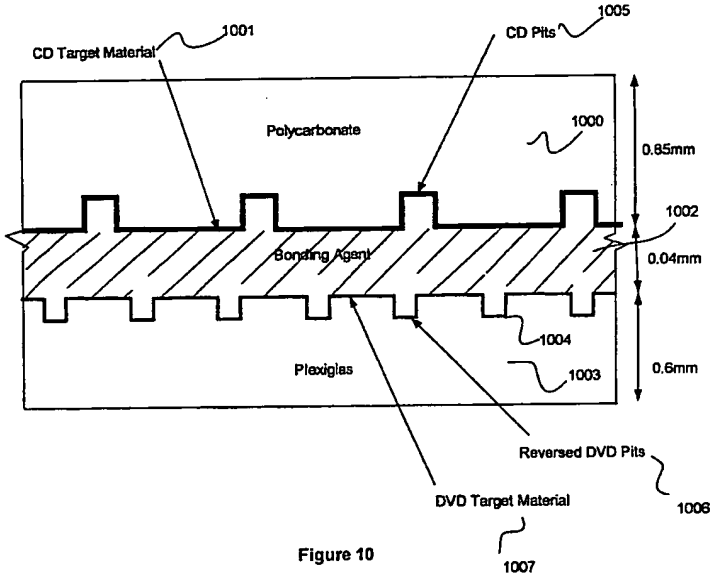

Figure 10

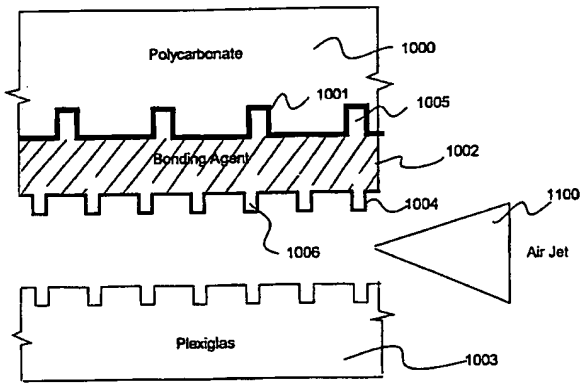

Figure 11

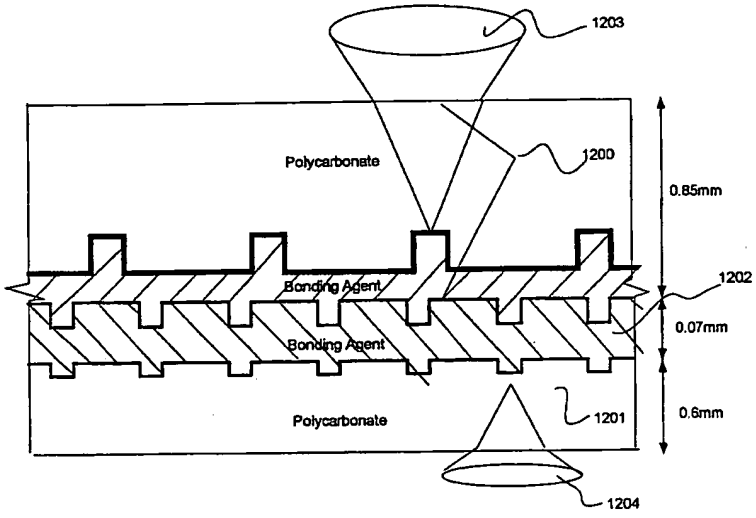

Figure 12

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/01026

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. [7]: G11B 7/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
WPAT. Keywords: DISC, CD, DVD, HYBRID and similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	Derwent Abstract Accession No 99-332442, Class T03, JP 11120617 A (SONY CORP.) 30 April 1999	1-13
X	WO 01/11617 A (FREDERICKSEN et al.) 15 February 2001 Abstract; Figures	1-2, 9, 11, 13
X	WO 98/38637 A (WEA MANUFACTURING INC.) 3 September 1998 Abstract, Figures	1-2, 9, 11, 13

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
9 October 2003	16 OCT 2003
Name and mailing address of the ISA/AU	Authorized officer
AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaustralia.gov.au Facsimile No. (02) 6285 3929	**ROSEMARY LONGSTAFF** Telephone No : (02) 6283 2637

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU03/01026

C (Continuation). **DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 899723 A (SAMSUNG ELECTRONICS CO. LTD) 4 September 2002 Claim 2	1-2, 9, 11, 13
X	Derwent Abstract Accession No. 00-444097, Class T03, EP 1006513 A (DIERKS) 7 June 2000	1-2, 9, 11, 13
P,X	GB 2380595 A (FLIPPERDISC LTD) 9 April 2003 Page 4, line 29 - page 5, line 2; Figures; Claims 8, 10	1-13
P,X	Derwent Abstract Accession No. 03-422656, Class T03, DE 10150025 A (DIERKS) 17 April 2003	1-13